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An Analysis of the Effect of the Container Ship Revolution on Military Logistics

James H. Gallaher

The importance of the container ship for future logistical planning is difficult to overestimate. Because of this new development, a significant reduction in transportation costs and a revival of the U.S.-flag merchant marine are realistic prospects. These two trends will increase the capability of the United States to logistically support overseas commitments, but careful planning is necessary if their full effect is to be achieved.

AN ANALYSIS OF THE EFFECT OF THE CONTAINER SHIP REVOLUTION ON MILITARY LOGISTICS

A research paper prepared

by

Commander James H. Gallaher, U.S. Navy

School of Naval Command and Staff

> Spark for a sealift version of the industrial revolution has been ignited by those who have pioneered development of the container and containership.[1]

This statement by the Commander, Military Sea Transportation Service (MSTS) sums up the great changes which have been taking place in the merchant marine. The container ship revolution began in 1957 when Sea-Land Service, Inc., introduced three C2 cargo ships converted to carry 226 containers in Atlantic coastwise shipping. It took about 10 years for container ships to prove their value, and in 1967 the first container ships were built that were new construction and not conversions from older cargo ships. Since that time container ships have rapidly replaced traditional break-bulk ships in the U.S. merchant marine and hold promise of restoring the United States to a more competitive position in ocean trade.

The container is a simple aluminum or steel box, with doors at one end or at the side, into which break-bulk cargo is packed. For the first time in transportation history, an attempt has been made to standardize unit sizes of bulk cargo to be handled by truck or rail transport, dockside equipment, and the cargo vessel. The containers themselves are very flexible, being available in configurations such as wire mesh, tank, or an open structure which can be folded flat for storage.

The key to the efficient operation of container movement is standardization not only of container sizes, but of

corner fittings and equipment needed to fasten and move the containers throughout their movement cycle. Ideally, the container is sealed at the initial shipping point and remains unopened until its final destination, thereby reducing handling of the cargo and preventing loss, misplacement, and pilferage of cargo.

With the revolution of transporting material, it has become necessary to design a new range of equipment for the effective and efficient movement of containers. It includes, for example, special truck chassis, rail flatcars, mobile container stackers, and transporters. It has also been necessary to construct integrated ocean terminals with container stowage areas and special dockside cranes.

Of prime importance to the military shipper has been the necessity for designing a tailored ocean vessel for the carriage of the containers. These vessels have become known as "cellular container ships." Within the holds there are cellular structures of angle iron forming container guides onto which the containers are stowed. The container movement within the ship is vertical only, and therefore large hatch openings are required to make maximum use of the ship's hold. On many of these ships no cargo-handling facilities are provided, thus these ships operate only from special container ports which are equipped with highly automated gantry cranes to load and unload the ships.

In such a highly automated system a very fast turnaround time is achieved, as it is possible to unload and load a container every 4 minutes. The time in port is therefore cut to a matter of hours rather than the weeks necessary for a standard dry-cargo ship. The maximum economy of containerization is realized only if this high speed of loading is achieved.

Revolutionary Changes in the U.S. Merchant Fleet. As shown in table I, the present U.S. privately owned dry-cargo fleet consists of 598 ships with an average age of 19.2 years. Of this total, 96 ships are container ships representing 185 notional ship equivalents. In other words, the average container ship can replace about two average dry-cargo ships. This replacement factor is lower than might be expected because the container ship fleet has many units which were converted from conventional cargo ships which are smaller and slower than the second generation of container ships. Based on the efficiencies of the second generation container ships, the replacement factor would be much higher. Container ships which have been built new, as opposed to those converted from conventional

TABLE I—DEVELOPMENT OF U.S. PRIVATELY OWNED DRY-CARGO FLEET[a]

Year	Total No. Ships[b]	Avg. Age In Years[b]	Total Container Ships	Total Notional Containar Ships
1950	593	7.5	--	--
1955	620	11.9	--	--
1965	557	18.2	33	43
1968	599	19.2	78	136
1969	598	19.2	96	185

[a] Excludes bulk cargo, reefer, and coastal ships.

[b] *Source:* U.S. Military Sea Transportation Service, *Merchant Ship Register,* July 1969, p. I.

cargo ships, will have an average replacement factor of more than 4 to 1 by 1973.

An example of second generation container ships is the U.S. Lines *American Lancer*, which carries 1,200 20-foot containers, has a cruising speed of 21 knots, makes a round trip from the United States to Europe every 21 days, and replaces 17 standard World War II freighters. Sea-Land Service, an unsubsidized U.S.-flag carrier, is building in an overseas shipyard five 33-knot container ships which will each carry 1,000 containers.[2]

As can be seen from the above table, the total number of ships in the U.S. dry-cargo fleet has remained relatively static for the last 20 years, and the majority of the ships in the fleet are nearing retirement age. Significantly, container ships are rapidly becoming a substantially larger part of the total fleet, going from 5 percent of the fleet in 1965 to 16 percent in 1969. Projections for the number of container ships in the merchant fleet by 1973 indicate a total of 131 container ships representing 371 notional ship equivalents. From the high average age of the total merchant fleet, it is apparent that there will be a large reduction in the number of conventional dry-cargo ships in the near future and a related increase in the percentage of container ships. For the military contingency planner, who must rely heavily on ocean shipping for logistic support, these revolutionary changes have far-reaching consequences.

Included in the 1973 projection of 131 container ships are 14 newly developed barge-carrier ships which are under contract in U.S. shipyards. The operational concept of these barge-carriers centers on the shipper loading his goods into a large barge or medium-sized lighter at either a river or ocean port. The barge or lighter is then moved by tug to the oceangoing ship's side, where it is then loaded aboard and carried to its port of destination. In the delivery port the barge is put into the water outside the congested port area, and the craft are then towed to local warehouses or through inland waterways to the ultimate destination. There are currently two different types of barge-carriers under construction and a third type in the preliminary planning stage.

The first barge-carriers to be built are the Lighter Aboard Ship Handling, or LASH, vessels which will be 814 feet long with a draft of 28 feet and will carry 61 barges with a capacity of 440 long tons each, or 1,508 containers. The barges themselves may be loaded with containers or break-bulk. Eleven of these vessels are to be constructed for U.S.-flag operation at a total cost of over $200 million. The LASH ship will have a 500-ton gantry crane capable of loading an entire ship of barges in 18 hours. The ship will have the flexibility to handle lighters, standard containers, bulk commodities, baled goods, machinery, refrigerated and general cargo and is expected to replace seven general-cargo ships on an Atlantic shipping route. Delivery of the first U.S.-flag LASH is scheduled for 1970.

A second type of barge-carrier is represented by the so-called SEABEE-class barge and intermodal carrier. Three ships of this type are under contract at a cost of over $32 million each and are scheduled to enter service in 1971.[3] They will be 875 feet long with a draft of 31 feet and will carry 38 barges with a capacity of 850 long tons each or 1,600 standard containers. Loading will be by use of a submersible elevator located at the stern which will have a lifting capacity of 2,000 tons. The ship is designed to be highly flexible, combining the characteristics of a barge-carrier, roll-on/roll-off vessel, container ship, unitized or pallet carrier, heavy-lift vessel, or quasi-tanker. It is not cellularly constructed and, as a consequence, is not restricted to a single barge size.

A third type of barge-carrier ship, the "Stradler," is only in the planning stage

of development. It is conceived as a giant catamaran 1,160 feet long that will carry ten 12,000-ton satellite barges. The cost, estimated at $16 million, will be less than either the SEABEE or the LASH, but the "Stradler" will carry many times more cargo.[4] The cost of such large barges, however, will greatly increase the cost of the total system.

Another special category of ships which is included in the current 96-ship container fleet is the roll-on/roll-off ship. Six of these ships, capable of carrying wheeled vehicles or other units, are in service now. One of the largest is the GTS *Admiral William M. Callaghan*, which is privately owned and chartered to MSTS. The *Callaghan* has been operating for the military from the U.S. east coast to Bremerhaven, Germany, since 1967, carrying autos, military vehicles, and containers. Experience with this type ship has demonstrated significant benefits to the military in the form of flexibility and reduced transit and port handling times.[5]

The biggest roll-on/roll-off ship in commercial service is Transamerican Trailer Transport's *Ponce de Leon* which carries no containers or general cargo. The *Ponce de Leon* is a 700-foot, 26-knot ship which was designed for rapid drive-on loading and, unlike earlier roll-on/roll-off vessels, was built with three large side openings connected by ramps to the dock and leading inside the ship to three trailer and two auto decks. The ship carries 260 40-foot trailers and more than 300 autos or trucks on a New York to San Juan run. It can load and unload in as little as 8 hours.[6]

Military Requirements for Ocean Shipping. In an age where great tonnages of cargo are whisked around the world in a matter of hours, the military need for a large dry-cargo sealift capability may be questioned by some. However, because the U.S. military must rely heavily on peacetime commercial capability to support wartime operations, economics dictates a primary reliance on ocean shipping to support military operations 30 days after the outbreak of hostilities. With the innovations taking place in shipping, this reliance should continue into the foreseeable future.

In fiscal year 1969, 30.9 million measurement tons of military cargo were sealifted, more than any year since World War II.[7] This is even more than the total of 28.5 million measurement tons shipped in 1953 during the height of the Korean conflict.[8] Roughly 94 percent of cargo movement to Korea was by commercial ships, and 96 percent of military cargo has moved to Southeast Asia by commercial and Government sealift.[9] Of the 30.9 million measurement tons of military dry cargo moved by sealift in 1969, 3.5 million measurement tons were containerized. The use of container service by Department of Defense shippers for export cargo has shown steady growth in both tonnage and in number of containers from the first quarter fiscal year 1967 through fiscal year 1969. The full potential of containerization has not yet been realized by the Department of Defense. It is estimated that more than 50 percent of all military cargo is amenable to movement in a containerized system.[10] The container ships operating under the U.S. flag in 1969 were capable of transporting 18.6 million measurement tons, and by 1973 their capability should reach 37.3 million measurement tons.

Although some military transportation managers have expressed opinions that more container capability could be used by the Department of Defense, especially in South Vietnam, the total capability available appears to be adequate for the near future. It should be noted that the conflict in Southeast Asia has been adequately supported without resort to the requisitioning of ships, a power which is available to the

President during periods of full mobilization.

In spite of some initial difficulties, the present combat operation in Vietnam is being adequately supported by the current fleet. This does not mean, however, that capabilities will be adequate for a future war. MSTS has expressed doubt that the U.S. merchant marine has the capability to support a major mobilization for war.[11] The reason for this pessimism by MSTS is the general overage of the U.S. merchant marine and the more immediate prospects of modernizing this fleet. While it is apparent that merchant ships will not be replaced on a one-for-one basis, much of the lost capability is being substituted by new container ships. For a 1-year period ending 30 April 1969, 57 dry-cargo ships were scrapped, while the notional ship equivalent container ships built in 1969 were 49.[12]

While the replacement criteria for 1 year does not establish a trend, it does appear that container ships do hold some promise of replacing the capability of the shrinking merchant fleet. There exists a related problem. Will the container fleet have the flexibility necessary to sustain future military operations? Two elements of the problem of flexibility are: (1) will there be adequate conventional break-bulk or roll-on/roll-off ships to move the 49 percent of military cargo that cannot be moved in container ships; and (2) is there danger that container ships will be of little use in contingency operations in underdeveloped areas because they require special cranes at the ports? Both of the above questions can be partially answered from table II.

Table II indicates that a total of 11 self-sustaining ships and 5 nonself-sustaining ships were built in 1969, and 21 self-sustaining ships and 14 nonself-sustaining ships are projected for the period 1970 through 1973. This comparatively brief period of time does not substantiate a trend, but it does show the current inclination of U.S. shipowners to want the flexibility of being able to handle both break-bulk and container cargo. All of the self-sustaining ships listed above are capable of carrying break-bulk cargo and of unloading in an overseas area without specialized cranes in the port.

Given the present condition of the merchant marine and the prospective modernization program, the capability of this fleet to support any significant future military operation is marginally adequate. In addition, the military services will be required to be much more conscious of individual ship scheduling in the future. With the advent of more specialized ships, additional consideration will have to be given to the type of cargo and the capability available for loading and offloading.

TABLE II—NUMBER OF NEW CONSTRUCTION DRY-CARGO SHIPS BY TYPE[a]

	Type of Ship	1969	1970-1973
Self-sustaining	Conventional Cargo	2	--
	Partial Container—60-70 ton booms	5	7
	Roll-on/Roll-off	4	--
	LASH/SEABEE	--	14
Nonself-sustaining	Full Container—No Cargo Gear	5	14

[a]*Source: Merchant Ship Register,* July 1969, p. V, VI, 1-32; *Marine Engineering/Log,* September 1969, p. 9, 71-73.

Areas for Exploitation by the Military. The economies of shipment by container are equally available to the military and the civilian shipper. The principal advantages of containerization over break-bulk shipment are:

1. The major economy comes from reduction of time spent in port by the container ship. The loading and unloading time of a ship by conventional methods is normally 5 to 8 days, whereas a container ship will take only 12 to 36 hours. This results in savings in the cost of handling the cargo and in lower operating costs for the ship itself.

2. Loss and damage are usually reduced. This includes loss from pilferage by cargo handlers, which is notoriously high, the inadvertent loss of small lots in transit, and damage to cargo during handling and transit. In addition to the monetary savings, this has the added advantage to military logistic support of insuring greater reliability of receipt of vital material.

3. Packaging is normally reduced, thereby reducing costs for preparation for shipment and transportation costs which are based on weight.

4. All of the above advantages result in lower inventory costs due to a shortened supply pipeline.

These economies of containerization are passed on to the military shipper. A representative sample of Department of Defense exports in containerized shipments to South Vietnam in 1967 was analyzed by the Military Traffic Management and Terminal Service (MTMTS) to determine the cost of containerization versus the movement of the same cargo as break-bulk. The landed cost was determined for 12 shiploads, a total of 196,772 measurement tons, that moved through a west coast commercial terminal to South Vietnam. The average cost savings for movement by container rather than by break-bulk was $8.24 per measurement ton for a total cost savings of $1,621,246 for the 196,772 tons moved.[13]

In another test, in shipments of 1 million measurement tons valued at $1 billion, the Army-Navy Exchange Service saved $25 million on pilferage and $1 million on transportation costs.[14]

As pointed out previously, over 50 percent of military export cargo is adaptable to containerization. With only about 11 percent currently being containerized, there is an opportunity for further economies in the expansion of containerization by the military shipper.

Providing there is already an established port complex in the theater of operations or there is time available to build one, one of the most important advantages of container shipping to the military logistician is better supply support.

At the beginning of the Vietnam buildup, large numbers of ships anchored offshore awaiting discharge, sometimes for weeks. This greatly inflated the number of ships required to support the operation in Southeast Asia and was costly. The solution to this problem required many actions, but the institution of container ship service to the Western Pacific area was a major factor in decreasing turnaround time for cargo ships. The present container ship system to the Republic of Vietnam provides for delivery of approximately 60,000 measurement tons per month. Container ships are turned around on the U.S. west coast in about 48 hours and in Vietnam in 24 to 48 hours. The average lift is 9,000 measurement tons for each of three C2 container ships and 24,000 measurement tons for each of three C4] container ships. On a west coast to Vietnam run, this capability equates to approximately 20 standard World War II Victory ships which constitute the major portion of the MSTS-controlled fleet today.[15]

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It appears that due to budget restrictions, Congress has permanently shelved the Fast Deployment Logistic Ship (FDL) project. All of the military services were agreed that an FDL program was required to provide rapid reinforcement of U.S. forces in limited wars during the 30 to 60 day period after hostilities began. In the FDL concept, Army material would be stowed in FDL ships and maintained in a high state of readiness. The ships, with a 28-foot draft, would be capable of unloading in 72 percent of 1,000 established world ports or over the beach. Capacity was to be 11,000 short tons and the cost of the first FDL approximately $46.8 million.[16]

The LASH or SEABEE barge-carriers discussed previously offer a viable and economical alternative to the FDL program. With 14 of these new ships scheduled to be in operation by 1973, it would be very practicable and relatively inexpensive for the Department of Defense to buy a number of barges and preload them in line with the FDL concept. The LASH ships are designed with a 28-foot draft and would therefore have the same accessibility to world ports that the FDL would have had.

There are some deficiencies in substituting barge-carriers for the FDL. Both the LASH and SEABEE are designed to discharge in still water. They are, however, much more flexible than conventional cargo ships or container ships. Barges can be towed up inaccessible rivers by tugs which can be carried to the overseas area on the mother ship. Another drawback is that any casualty that immobilizes the shipboard crane would stop operations completely. Additionally, the lighters or barges are not presently designed to be self-propelled or to provide over-the-beach discharge. The barges are also not capable of being discharged at their destination without a crane on shore. This crane, however, need be only a relatively small mobile crane which could be carried on the ship and moved ashore with the first load of cargo. One or more helicopters could also be carried on board the LASH or SEABEE ship to carry containers directly to the area of operations.

Once a sufficient fleet of barge ships comes into existence, there are many additional developmental opportunities which should be exploited by the military. Barges could be easily developed for over-the-beach operations, outboard motors could be carried on the mother ships and attached to lighters upon arrival overseas, and specialized barges could be developed to carry troops and their equipment.

By carrying troops in air-conditioned barges on the upper deck of the barge-carrier along with their vehicles on the lower decks, either roll-on/roll-off or in landing craft, the barge-carrier would represent a truly mobile striking force. These features are readily available without design changes in the SEABEE-type ship. The Department of Defense should explore this concept in depth with a view toward eventually leasing or buying barge-carriers for military use.

That the U.S. merchant marine is foundering is a much discussed fact. From 1950 to 1967 the percent of U.S. foreign trade carried in U.S.-flag ships dropped from 39.3 percent to 6.5 percent.[17] The industry is handicapped by high labor costs for ship construction and cargo handling. Currently the cost for loading and unloading ships in the United States is 3 to 10 times foreign costs, and ship construction costs are 2 to 3 times those of foreign shipyards.

The only way U.S. ocean carriers can effectively compete with foreign-flag carriers is to change from a labor-intensive industry to a capital-intensive industry. The United States has traditionally had a competitive advantage over foreign competition in areas which require technology and capital.

Container ships appear to be on the verge of restoring the American mer-

chant marine to a competitive position, which is of vital interest to military logistic support. The technological advantages of the container revolution coupled with a second generation of container ships utilizing the economies of large size and high speed have already recaptured some of the ocean cargo trade for U.S. ships. During the second quarter of 1969, U.S.-flag ships carried 58.6 percent of all container traffic in the North Atlantic and 64.8 percent of all container cargo in the west coast-Far East trade.[18]

Containers offer an opportunity to increase the military peacetime readiness position for wartime operations. Historically the military has had to pick, pack, and mark equipment and supplies and move them in many small lots. This has been time consuming, and the process has often misplaced many vitally needed items within the logistic supply system.

Prepacking may prove to be cost effective if a trade-off can be found whereby investment in prepositioned war reserve material is reduced and several potential trouble spots are covered with a single reserve. It is quite possible that the best combination of maintaining a capability for deploying war reserve material will come from centralization of stocks in the United States in prepacked containers ready for rapid deployment. The trade-off would be realized through the reduced cost in facilities, maintenance programs, and inventory investments in the overseas commands.

Potential Problem Areas. While containerization is an exciting new development in transportation and offers many areas for exploitation by the military, there are also several potential problem areas which offer a challenge to the military logistician.

It is perhaps a paradox that the technological improvements that have made container ships more efficient and economical pose the biggest problems for military logisticians. A major factor in the design of most general-cargo ships has been flexibility, a feature that is not compatible with the efficient handling of containers. The main characteristic of the most economical container ship service is a relatively few large container ships serving a relatively few fixed terminals with the cargo handling gear permanently installed and with feeder ships operating out of the heavy density terminals to service other ports in the general area.

For reasons of economics, many container ship operators prefer a shore gantry crane to cargo gear installed on the ship. This preference is based on the rate at which containers can be loaded or unloaded rather than the comparative cost of each system. The actual cycle time for shipboard gantry cranes is about one-half that of a conventional shipboard boom, while a dockside gantry is almost twice as fast as the shipboard gantry.[19] The shipboard gantry is likely to be more reliable than a shore-based crane on a sustained basis because it is less subject to wind effects and pendulating and can be spotted more easily.

Container ships which are not self-sustaining, that is do not have cargo handling gear on board, may pose a problem for the military. Projections of the container ship fleet for 1973 indicate that approximately 50 percent of the fleet will not be self-sustaining. This has little military implication during peacetime since an extensive worldwide automated container port system is already in being. During wartime, however, these ports would be highly vulnerable and if destroyed would greatly reduce the sealift capability available to the military. Additionally, it may be assumed that future contingencies will be in undeveloped areas of the world which do not have container port facilities.

There are answers to this problem of flexibility. The LASH, SEABEE, and

roll-on/roll-off ships already discussed represent a reversal in the trend toward ships which are not self-sustaining. Both the Naval Facilities Engineering Command[20] and the Maritime Administration[21] have made recent studies of portable port concepts and have determined that practical systems can be developed that will allow unloading of cargo ships in areas that have had their port facilities destroyed. Both studies have included a capability to unload containers; however, the Maritime Administration study only addressed unloading of self-sustaining container ships.

Another possible solution to nonself-sustaining ships is for the Department of Defense to subsidize the extra cost of shipboard gantry cranes. This solution is of doubtful merit since the purpose of the shore-based crane is to speed up container handling, and adding shipboard cargo handling gear would defeat this purpose.

One of the better solutions is for the Department of Defense to promote the development of barge-carriers through long-term charters of this type ship by MSTS. Although Congress has not appropriated funds to buy ships for the MSTS nucleus fleet, MSTS has been given permission to negotiate for ships on a long-term charter basis. Barge-carriers offer the most flexibility of the new ships being built and also offer an opportunity for analysis of actual operations.

A Japanese-built LASH ship recently began operations between the U.S. gulf coast and Europe. Its operations can be observed to determine actual operating conditions and efficiency, and if operating experience shows that the LASH performs to designed characteristics, MSTS would then be justified in chartering this type ship on a long-term charter basis. This would have two beneficial results. The military services would be assured of having at least some flexible ocean shipping capability during the initial buildup of a contingency operation, and by chartering commercial design ships MSTS would increase shipyard production, thereby lowering unit costs on barge-carriers and increasing the likelihood of commercial buys on these ships. This, in turn, would increase the overall flexibility of the merchant fleet.

It should be pointed out that non-self-sustaining container ships do have flexibility of a kind. The experience of one container ship operator, Overseas Containers Limited, has demonstrated the adaptability and flexibility of container ship service. They began operation of a full container ship, carrying 1,300 containers, in March of 1969 between the United Kingdom and Australia. Because of labor problems the company was unable to use a special container port which had been built in England. Instead, Rotterdam and Antwerp were used by utilizing a large-scale switching operation. This involved using these alternate ports and a combination of short sea and rail service for a feeder operation between the ocean ships and their United Kingdom markets. The ease with which container cargo can be handled enabled this transshipment to take place in a manner which would not be feasible for general-cargo ships. The shipper has not suffered a significant loss of time on the switch. Cargo transshipment time from Antwerp to England has added only 60 hours to the total trip.[22] This flexibility is highly significant to the military for peacetime operation and for wartime operations in developed areas.

Progressive substitution of very large and highly productive ships for several older ships may present another very significant problem to military planners. The possibility of loss of several large container ships may make U.S. military logistic support highly vulnerable. There is no doubt that the trend is to fewer ships of larger capacity, so it is imperative that the military have effective

plans to counteract enemy threats to ocean shipping in time of war. Shipping losses as experienced in World War II simply could not be tolerated.

In the past, one of the biggest problems in safeguarding ocean shipping has been the slow speeds of merchant ship convoys. With larger and faster merchant ships, the convoys will be faster and there will be fewer ships to protect. These two factors should afford a much higher degree of protection from an enemy threat, especially the submarine threat. Additionally, the short port turnaround time of the container ships is a decided advantage, since ships in port are highly vulnerable to enemy land, sea, and air attack.

A problem related to unloading containers in an undeveloped area is that of specialized equipment. Once the container is unloaded from the ship, it requires different handling than break-bulk cargo. Some form of special material handling equipment is required to move the container from the dockside to hardstands, marshaling yards, or break-bulk points. This equipment, which includes truck chassis, forklift trucks with special attachments for container handling, and straddle carriers, is readily available as off-the-shelf items. In undeveloped areas, however, this type equipment will probably not be available. This is a relatively easy problem to solve with prior planning to insure adequate equipment is shipped to the overseas port along with the first container ship of cargo.

One new concept which appears promising for solving the problems of destroyed ports, port congestion, and shore-side material handling is the Ship/Helicopter Extended Delivery System (SHEDS). The essential components of the system consist of a ship with a suitable area for helicopter pickup, the helicopter system, and the container or unitized cargo. The advantages of the SHEDS system are port and beach congestion can be bypassed, and delivery can be made to areas where no port facilities are available. The trade-offs in terms of savings in port development could be significant for short-term operations and more than compensate for the added cost of the helicopter system. Initial studies made by MSTS indicate a helicopter discharge system can be cost effective if properly employed.[23]

There are two major shortcomings of the SHEDS system. It can only be used on ships which are self-sustaining, and the helicopters are highly vulnerable in a combat zone.

The military operates ocean terminals on both the east and west coasts and is studying the need for container operations at both locations. There have been no studies completed on the necessity for military owned container handling capability.

Jane's Freight Containers 1968-1969 lists six U.S. west coast, seven U.S. east coast, four U.S. gulf coast, and 32 other world ports which have extensive container handling capabilities. For example, at Howland Hook, Staten Island, American Export Industries is constructing a unique container terminal which will have three berths so highly mechanized they will be capable of handling the equivalent of all the general cargo moving through the port of New York at present, about 14 million tons per year.[24]

From the extent of commercial container port capability available, the assumption can intuitively be made that the military do not need their own container ports in peacetime. Military requirements during war, however, are unique. Ammunition shipments during wartime comprise a large part of the total military cargo and must be handled through special ocean terminals. Because of the special nature of ammunition handling facilities, it has been found that the Government must own these facilities. In any future war, ammunition will be handled in some

form of container. It will therefore be necessary for the military to have some container handling capability, at least at ammunition terminals.

This area needs further study to determine whether funds could be spent more advantageously in developing a SHEDS system, a portable port, or for military application of the barge ship rather than on U.S. port facilities.

If the military shipper is to realize the optimum benefit from the growth in containerization, the consolidation of small shipments must be exploited. When small shipments are consolidated, control improves, transit times are reduced, and lower transportation costs are realized. A small shipment consolidation test was conducted by the Military Traffic Management and Terminal Service (MTMTS) last year, using a commercial contractor in Philadelphia.[25] This resulted in considerable savings to the Department of Defense and, as a consequence, has become a continuing operation. With the gradual replacement of the break-bulk ocean fleet with container ships, cargo consolidation operations will have to be expanded. It remains to be determined if military operated consolidation points would be more economical than commercial ones.

The International Standards Organization (ISO), of which the United States is a member, has adopted as size standards for containers an 8½-foot height, 8-foot width, and 10-foot increments of length up to 40 feet.[26] These standards have been accepted by the American Standards Institute (USASI) and the American Bureau of Shipping (ABS) and are designed to facilitate the movement of containers on an international basis. They are a common denominator for international commerce but have not been accepted by all U.S. container operators. Manufacturers and users continue to design containers based on economic considerations rather than ISO standards. None of the containers owned by two major container lines conform to these ISO standards, and containers are not normally interchanged between container lines.[27] The ocean carriers must use a container which can be economically handled by a truck, and therefore length is the most controversial dimension. Engineers are working on the problem of adapting vessels to various size containers. The SS *Hawaiian Progress*, a new 34,000 ton container ship, has been designed with the capability to handle containers of virtually any size.[28]

Quite possibly there is no valid need to have a single size for commercial containers. The size should be based on how the container will be used; that is, the container should combine the requirements of the two or more modes between which it will be transferred.

The standardization problem is, however, vital to military strategic planning. The military presently owns 200,000 containers of an 8½-foot by 6¼-foot by 6-foot 10½-inch size. These nonstandard containers were developed before the advent of cellular container ships and were designed to be moved on break-bulk ships. The military has a future requirement for a substantial inventory of its own containers in order to exploit the advantages of containerization in prepositioning stockpiles, for containerization of partial or complete depots in the United States for automatic resupply of committed combat forces, and for use where there is no commercial service or commercial service is inadequate.

The Department of Defense is now engaged in procuring a second generation container of 20-foot length which will conform to ISO standards.[29] Additionally, the Army Materiel Command is experimenting with a TRICON of a 8 by 8 by 6 2/3-foot size which will allow coupling of three containers to form a 20-foot standard unit.[30]

In the light of the rapidly growing cellular container ship fleet, the Depart-

ment of Defense should assure that new container procurement will result in containers which are capable of being handled by the largest number of ships. Now and into the future this means containers which conform to ISO standards. Standard containers for military use will insure that the widest possible advantage will be taken of economics of containerization and will greatly reduce requirements for organic cargo handling equipment, both at the ports and over the road.

Some nonstandard containers may be required for the Department of Defense. In some areas it could be more economical to use a nonstandard special purpose container and handle it on break-bulk ships or as deck cargo. There should be no question, though, that the flexibility required in military logistic operations demands that the vast majority of military owned containers conform to ISO standards.

The container ship industry has many other administrative problems such as customs procednres, documentation, insurance, and registration of containers. These are being tackled by various international organizations and will not be covered here as they are not vital to military operations.

Conclnsions and Recommendations. Container ships and special purpose ships are presently a significant part of the U.S. merchant marine dry-cargo capability and will be an even more substantial part in the future. This will affect the flexibility of the commercial ocean carriers to respond to future demands for support of military operations. The military is heavily dependent on ocean shipping for logistic support and must be aware of these changing capabilities.

Even though the makeup of the fleet has changed, the total capability to support military operations short of a general war is adequate for the foreseeable future. This does not mean, however, that the military services do not have to make changes in planning for future logistic support. The container revolution has many problem areas, as well as areas for exploitation, and the military planner must be aware of these.

The major problem area is the loss of some flexibility in relation to cargo choice and in loading facilities. To solve this problem it is recommended that:

1. Container ship limitations and capabilities be included as an integral part of future logistic support force studies to enable military planners to become familiar with limitations of the merchant fleet. Advantage of speed and size, limitations on flexibility, scheduling problems, and vulnerability of each of the specialized ships—LASH, SEABEE, cellular container ships, and conventional cargo ships—should be considered.

2. Vulnerability, speed, and numbers of container ships be considered in developing contingency plans for future convoy operations.

3. A mobile emergency port be fully developed and procured by the Department of Defense. The approach should be in line with the study on portable ports conducted by the Naval Facilities Command and should include the capability to unload container ships which are not self-sustaining.

4. The Ship/Helicopter Extended Delivery System (SHEDS) program be fully developed by MSTS so that it will be operational for future contingencies.

5. The Department of Defense initiate a major study on the possibilities available to the military in the nse of barge-carrier ships for fast logistics replenishment. The study should lead to development and procurement of specialized barges and procurement of barge-carrier ships through long-term charters by MSTS.

Military ownership of container ports is an area that requires more study. In view of the large number of commercial

container port facilities available, the necessity for construction of high-cost military container ports, except for ammunition handling, is questioned.

Containerization offers several areas for improvement in military logistics support, both in reliability and in the reduction of transportation costs. To take advantage of these savings it is recommended that:

1. Military container shipments be increased to the maximum extent possible through expansion of the shipment consolidation operation begun by MTMTS. Further study should be undertaken to determine whether container consolidation points should be military or commercial operations.

2. The Department of Defense study the cost effectiveness of prepositioning stocks in containers for rapid deployment to overseas areas of operation.

The container ship revolution promises many advantages to the Department of Defense, including the restoration of the merchant marine's capability to support defense requirements. The problems of containerization, inherent in any major technological change, can be solved and turned to advantage with awareness and proper planning by the military logistician.

BIOGRAPHIC SUMMARY

As a supply officer, Comdr. James H. Gallaher, U.S. Navy, has had considerable experience in both logistics and transportation. After graduating from Miami University in 1955 with an undergraduate degree in mathematics, he attended the U.S. Naval Supply Corps School in Athens, Ga. Since then he has served in a variety of billets ashore and afloat, including a tour as Executive Officer of the Director of Plans in the Military Traffic Management and Terminal Service. Commander Gallaher is a graduate of the School of Naval Command and Staff at the Naval War College and holds a master's degree in international relations from The George Washington University.

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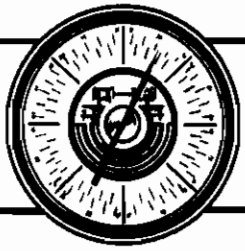
There must be no doubt that we can carry the trade, and our goods and our ideas to all the nations.

Representative Herbert C. Bonner
on National Maritime Day,
Fort Eustis, Va., 22 May 1961



THE BAROMETER

(This discussion comments on Professor Vincent Davis' proposed "Universal Service: an Alternative to the All-Volunteer Armed Services" published in the October issue.)

. . . Professor Davis succeeded in scuttling his own proposal by recognizing that present antiestablishment youth would never politically permit a national policy of manpower allocation. In all the discussions pro and con of an all-volunteer force, including the Gates Commission report, none have focused exclusively and in depth on the potential military recruit, his motivations, aspirations, goals, and values. I would like to inject some thoughts for further study by Professor Davis or others at the Naval War College.

(1) The draft has been a *major*, but not the *only* motivation for youth enlisting in the armed services. This statement is supported by recent experience with the draft lottery system. Many of the current recruits do not wait to know their lottery number but enlist on graduating from high school. These are what we in the Recruiting Service, call "runners": people who for one reason or another want to leave home after graduation. These "runners" are not limited to poor, blacks, or blue collar sons, but are a cross-section of middle-class America, "When" they run is dependent on conditions. They won't run from Cape Cod during the summer season nor from Aroostook County, Me., during potato picking time. They may stick around for summer employment or a girl, but soon tire of a $70 per week dishwashing job. The vast majority of naval recruits from July to December are composed of these individuals. The draft is simply not breathing down their necks at that moment. They could opt to wait for their lottery drawing if the draft were the only motivation.

(2) Because of the above, the statement that the armed services under an all-volunteer force would be composed of blacks, poor, and blue collar sons is unsupportable. It can be supported, however, that the percentage of first-term reenlistments and thus career personnel are highest among (1) blacks, (2) persons from rural areas (the South, northern New England, etcetera), (3) persons from substantial unemployment areas, and (4) persons from lower socio-economic groups. The origins of career designated personnel would probably remain unchanged under any system for initial enlistment.

I would not dismiss the all-volunteer concept too readily. It may have some beneficial side effects, such as better career motivation, increased operating efficiency, and greater job satisfaction for first-term recruits. Nor would I concentrate solely on increased pay to make the all-volunteer concept work. Certain administrative steps can be taken now by the Navy at little increase in cost:

(1) Assignment of younger, career petty officers to the Recruiting Service, who have charismatic appeal, public relations flair, and could become effective Navy ambassadors in the community to offset current antimilitary feelings. Motivational studies show that the recruiter is of major importance in affecting a young man's decision to

enlist. The assignment of a greater number of first and second class petty officers would enable civilians to better identify the Navy uniform–The *mod* look—which is not true for the chief petty officer and officer uniform. Also, especially in the case of minority groups, assignment of younger career petty officers would assist in closing the generation gap between recruiter and potential applicant.

(2) School guarantees for qualified applicants. Too often a potential applicant is lost to another service because of the Navy's inability to guarantee specific training. Out of necessity, in the past, the control of recruits to various training activities required centralization of classification and assignment functions to preclude the possibility of too many cooks and no technicians. However, with the development of computerized information systems, it would seem beneficial to decentralize the classification process to the main recruiting stations in order to provide school guarantees for highly qualified applicants.

(3) Greater recognition of civilian training. We have cases where individuals have spent 1 year in data processing training but are rejected for DS/DT rating because they did not receive training in one or two specific pieces of equipment.

(4) Establishment of a mutual contract, rather than a perpetuation of the present feeling of signing-your-life-away on the part of the individual. This could be accomplished by establishing a training/enlistment contract. The Navy would provide x training in return for x years enlistment. Training would include recruit training and Class "A" school training. The enlistment contract would take effect on the completion of all training.

(5) Adjustment of monthly quotas to conform to those periods that youth seek enlistment. It has been our experience that the most qualified applicants enlist between July and December of each year. By January through May, the Recruiting Service is scraping the bottom of the barrel and has problems in filling quotas. There are reasons, of course, for keeping monthly quotas quite uniform: school seat capacities, recruit training command capacities, and budget. However, it would seem the prime mover in this system of distribution should be the youth themselves. A model for this system could be formulated, using the techniques of system dynamics and MIT's Dynamo computer.

America's youth does not have its antiestablishment attitudes without some foundation. On the other side of the coin, I do not believe the Navy should be apologetic for any of its programs nor uncertain about its future under an all-volunteer concept. We have "an honored profession"; it can be challenging to the youth of today. It can be sold by recognizing that enlistment in the Navy has mutual advantages, for the individual and for the Navy.

H.A. BEAULIEU
Commander, U.S. Navy